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The establishment of a biological station at Wood's Holl, which, in the hands of Professor Baird, will doubtless be pushed to a speedy completion, will create facilities for the study of marine life on a much larger scale than we have hitherto seen in this country; and the successful issue of this enterprise, we venture to predict, will increase rather than diminish the number of American naturalists at Naples. Whatever improves our facilities for study will tend to increase the general interest in biology, and to augment the number of naturalists who will seek the best that the world affords in the way of methods. The time will never come when direct interchange of thought, and comparison of methods of research, will cease to be of the highest importance to the biologist. On the contrary, these things will become more and more a necessary part of the experience of every one who aims to be a useful and successful student of life. The progress of biological studies will soon create a demand for more than one international laboratory, and we certainly hope that the new station at Wood's Holl will take this character. The establishment of several great stations at different points, selected according to the relative richness and importance of the fauna and flora, each offering facilities for study similar to those enjoyed at Naples, and open to naturalists of every country, would prepare the way for a concentration and organization of forces, and inevitably raise the standard of work, and check the accumulation of driftwood. It is obvious that the usefulness of one station would not be impaired by the existence of others, since the work of each would be supplementary to that of the others.

The character and importance of the publications of the station have been so well stated by Mr. Cunningham in the article before referred to, that little remains to be said on this topic. In looking over the list of subscribers to the *Fauna and flora*, we are again forced to acknowledge the slender interest which America has taken in the Naples station. Here is a colossal series of magnificent monographs, designed to give an exhaustive treat-

ment of the plants and animals found in the Gulf of Naples, and published at a price that ought to insure them a place in the private library of every zoölogist and botanist in the country; and yet the list of subscribers, according to the last circular, numbers only eight. Even such countries as Holland and Switzerland outdo us. Austria and Russia have each twice this number of subscribers; Italy has nearly four times, England about five times, and Germany ten times, as many.

As our poor representation cannot be attributed wholly to indifference, it is safe to conclude that these monographs are not so generally known as they deserve to be. Thirty of the series have already been announced, six of which have been completed. From two to four are published each year in quarto form, and illustrated with numerous expensive plates, at an annual subscription-price of only twelve dollars and a half. The number of subscribers is now two hundred and seventy, and the three hundred and fifty copies of Dr. Chun's *Mono-graphie der Ctenophorae*—the first in the series—have been already nearly exhausted. The monographs are written either in English, German, French, or Italian, according to the preference of the authors. Such brilliant achievements in the line of exhaustive research as are embodied in these monographs certainly command our homage, and assuredly deserve a more generous recognition than they have yet received in this country.

C. O. WHITMAN.

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#### THE NATIONAL RAILWAY EXPOSITION.<sup>1</sup>—III.

IN England and Europe generally, signals of every conceivable variety have been used; but experience has shown that the semaphore is the best signal, and its universal adoption in Great Britain and on the busiest railways on the continent of Europe is a good example of the doctrine of the survival of the fittest. The exposition, we regret to observe, contains many forms of signals that are neither distinct in appearance nor positive in meaning. It is hard to say whether some of them mean safety or danger. A mere change

<sup>1</sup> Continued from No. 23.

of color from red to white, without any change of form, conveys no information whatever in certain states of the weather and with certain backgrounds. Other signals are alike, back and front. Facing the train, they signify danger; standing edgewise, they mean safety: but unfortunately it is difficult to know whether they refer to an east-bound train or a west-bound train; and, though they may be placed on the right hand of the engineer to whom they refer, this arrangement is not always free from ambiguity.

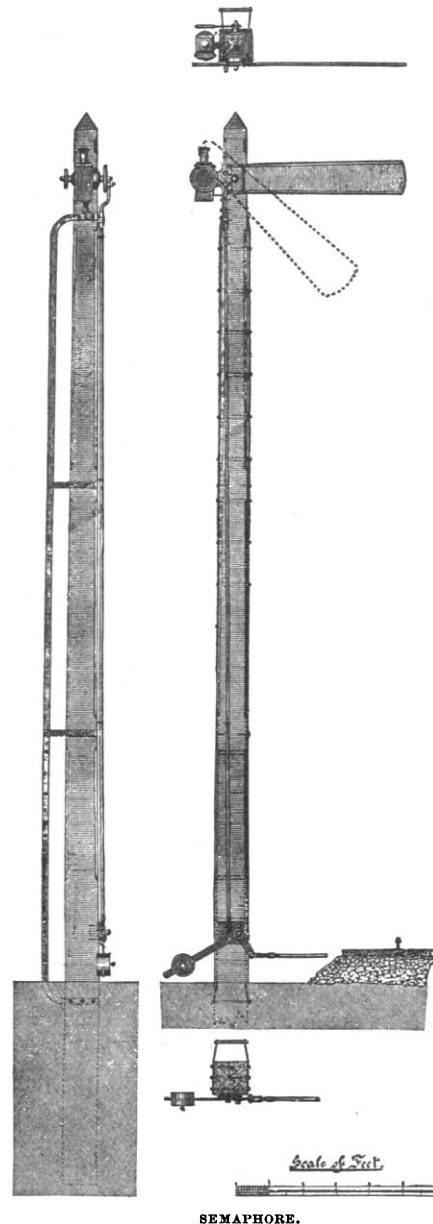
The semaphore signals, as shown at the exposition, consist of vertical posts which have one or more arms pivoted at their upper ends; and these arms are capable of moving through a right angle in a vertical plane. An arm raised to a horizontal position signifies danger; inclined at an angle of about  $45^\circ$ , it signifies safety. A powerful lamp is fixed near the top of the post; and, when the arm stands horizontally, a disk of red glass stands in front of the lens of the lantern, which then, of course, shows a red light, indicating danger. When the arm drops to an angle of  $45^\circ$ , the red disk moves, and leaves the lantern unobscured, showing a white light, and indicating safety.

The semaphore arms are weighted, so that their normal position is horizontal, indicating danger; and the signalman has to overcome this weight in pulling them to safety. The object of this arrangement is, that the breakage of the connection between the lever in the signalman's cabin and the semaphore will release the signal, and let it fly to danger.

It is usual to place one signal at or as near as possible to both the signalman's cabin and the spot where the engine of an advancing train should stop if the signal is against the train. This signal is called the 'home' or 'main' signal. Another signal is placed some distance off in the direction from which the train comes: this is termed the 'distant' signal. The object of this arrangement is, that, on catching sight of the distant signal, the engineer is warned, and has some time and distance in which to stop his train before he reaches the home signal, beyond which the danger lies.

As the levers work switches and signals at a considerable distance, the connections between them have to be carefully made and protected from accidental injury and the effects of the weather, while the difference in length due to difference in temperature has to be compensated for; so that the signal is moved with certainty, though the wire or pipe connecting it to the lever vary in length several inches in the twenty-four hours, owing

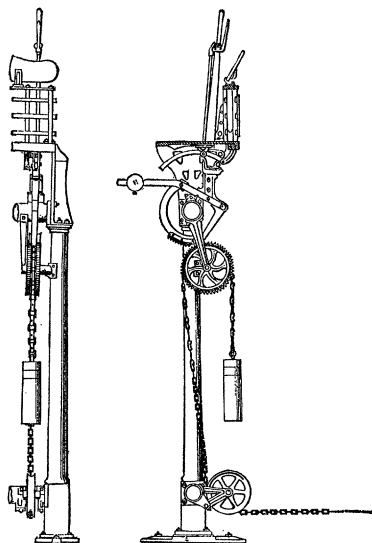
to the difference in temperature between the day and night. The Pennsylvania steel company exhibits an especially neat device for keeping the wire or connection to a dis-



tant signal always tight. The wire is kept stretched by an ingenious application of the pull of a weight, which acts only when the signal is in its normal position of danger to which it is weighted. When the signal is

pulled to safety, it is directly controlled by the signalman.

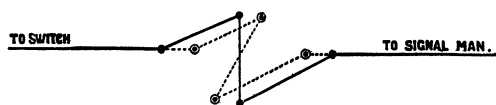
Connections to switches are generally made by means of rods or pipes jointed together,



DEVICE FOR KEEPING SIGNAL-WIRE TIGHT.

and running on rollers. A 'trunking' or wooden covering is then placed over them to protect them from snow and the feet of anyone walking about the yard.

As it is very important that the movement of switches should be absolute and exact under all conditions,—that is to say, that the switch be always either tightly closed or wide open, and never stand partly open,—a compensating arrangement is introduced half way between the switch and the signal, so that, whatever the variation of length of connection from temperature, the switch is unaffected, and its movements can always be under exact control.



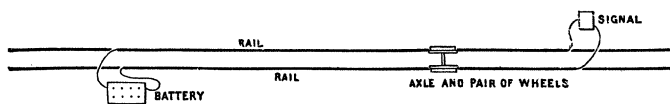
COMPENSATING JOINT FOR EXPANSION OF RODS.

The full lines show the position in cold weather; the dotted lines, in hot. It is evident, however much the rod expand, the distance between switch and signalman is unaltered, and therefore the movements of the switch and lever are unaffected.

In working railroads, some difficulty has

always been experienced in keeping trains running in the same direction, on the same line of rails, from running into one another, as naturally, on a crowded line, an accidental stoppage to even a fast train may enable a slow train to overtake it and cause a rear collision. The Pennsylvania railroad adopted, some years ago, what is known as the block system, by which a definite interval of space (the distance between two adjoining signal-cabins) can always be maintained between two following trains. The system is too well known to need description here; but Mr. George Westinghouse has invented a system in which the same results are obtained, not by men signaling from one cabin to another, but by the trains themselves operating signals through the medium of electricity. The principle of the invention is easily understood, although the details are complicated and the results marvellous. A battery is connected to each signal by means of the rails, the current flowing to the signal by one rail, and returning by the other. The presence of an axle and pair of wheels on the track enables the current to flow through them, instead of through the signal apparatus. Directly the current is thus short circuited, the signal flies to danger.

This simple principle is so ingeniously worked out in detail, that a train approaching a road-crossing rings a bell fixed on a post at the



AUTOMATIC ELECTRIC BLOCK SYSTEM.

crossing until the crossing is reached, when the bell stops ringing; and this is done by trains travelling in either direction. In working on an ordinary piece of road, two signals behind the train are always kept at danger; and, on a single line, two signals in advance of the train are always kept at danger against a train advancing in the opposite direction. In a few words, the trains warn one another of their proximity.

We have dwelt on the subject of signals at considerable length, as the question is novel, and of great and growing importance; and we have no doubt that those who take an interest in railroads have found much to be gained by visiting the exposition, and studying this question on the spot. The two exhibits we have mentioned represent the best results attained in England after forty years' patient and careful study of signals, under such trying

conditions that the very existence of railways there depends upon the handling of enormously concentrated traffic with safety, certainty, and rapidity; and the results of these labors are probably not far from a perfect solution of the problem, and deserve our most careful study.

(*To be continued.*)

#### FIFTEENTH ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.<sup>1</sup>—II.

ON Thursday the convention again assembled at St. Paul, at 11 A.M., and listened to a paper by J. P. Frizzell of St. Louis, upon the water-power at St. Anthony's Falls. The height of fall, watershed, rainfall, and horse-power utilized were given. He criticised the means taken for preserving the falls, the building of storage-dams at the head waters of the Mississippi, and the method of using the water at Minneapolis. He condemned the waste of power occasioned by a gross disregard of the laws of hydraulics, and pointed out the remedy. He stated that three things should be done,—the U. S. government must be induced to withdraw wholly, leaving the work of preservation of the falls to the owners of water-power; the two companies controlling the power must be united under one management; the natural width of channels at the falls must be restored.

Capt. O. E. Michaelis, U.S.A., followed with a short paper on metrological investigations, which he said were brought about by the attempt to determine how much a certain bullet was 'out of true.' He constructed and exhibited an instrument closely allied to the spherometer, to which he gave the name of 'tripod caliper.' He read results of measurements with this instrument, and applied it further to testing the accuracy of one turn of a screw-thread.

Mr. D. J. Whittemore, chief engineer of the Chicago, Milwaukee, and St. Paul railway, read a brief paper on the use of the Nasmyth steam-hammer for driving piles, and gave instances of the hindrance which a very slight 'brooming' of the pile-head offered to the effective action of the hammer. He also submitted a section from the top of a green Norway pine pile, where the friction of the fibres, under the rapid blows of the hammer, had generated sufficient heat to burn the heart of the head of the pile quite across.

Papers by Benjamin Reece, of Toledo, O., upon railway-track repairs, and by J. W. Putnam, upon cause of decay in timber, were read by title, and ordered printed in the proceedings.

<sup>1</sup> Concluded from No. 24.

In another room, before the persons most directly interested, a paper was read by F. P. Stearns of Boston, upon the current meter, giving a theory for the maximum velocity of water, flowing in an open channel, being found below the surface.

The society then held a business-meeting, in which a committee for nominating officers of the society was elected. Committees on uniform tests of cement and on the preservation of timber were granted further time. The committee appointed to procure aid from Congress to carry on the tests of iron and steel reported progress, and was continued.

The special committee on standard time made a report through Dr. Eggleston to the effect that they had obtained a general expression of opinion from men prominent as engineers, railway managers and operators, and others in all parts of the United States and Canada, and found that exceptional unanimity prevailed with respect to the fundamental principle which should govern in the adoption of a system of standard time for the whole country. The benefits of a change from the present lack of system were illustrated, and it was claimed that the time had arrived for action in the matter. The report was accepted, and the committee continued.

The convention at St. Paul then adjourned. The U. S. engineer officers on duty in this vicinity had an exhibit, in another room, of plans showing the various works of improvement under their charge.

On Friday, June 22, the convention met in Minneapolis. The party was carried from Hotel Lafayette across Lake Minnetonka by steamer, and thence by a narrow-gauge railway, in open cars, to the city. The meeting took place in the opera-house. A welcome was given by ex-Mayor Rand in behalf of the city; a reply and the annual address, in the absence of President Charles Paine, was read by Director William Metcalf, who took for his subject 'Engineering improvements in the Mississippi valley.'

Mr. William P. Shinn then read a paper upon the subject, 'How can railways be made more efficient in the transportation of freight?' which is a sequel to his paper of similar title read at the annual meeting in 1882, and aims to sum up the discussion, and more particularly to reply to the criticisms of Mr. O. Chanute thereon. He claims that facts and figures, which he adduces, prove that the present mileage basis for the adjustment of car accounts between different railroad companies is unjust to the companies furnishing the cars; that it is